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Validity of the Health Profile-Types of the Spanish Child Health and Illness Profile-Adolescent Edition (CHIP-AE)

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ABSTRACT

Objective: To develop and validate a simplified, easy to interpret scoring system based on the health profile-types taxonomy for the Spanish version of the Child Health and Illness Profile-Adolescent Edition (CHIP-AE).

Methods: The CHIP-AE was administered to a 1453 Spanish adolescents. Hierarchic and nonhierarchical cluster analyses, as well as conceptual considerations, were used to identify exhaustive, mutually exclusive health profile-types based in four CHIP-AE domain scores: Satisfaction, Discomfort, Resilience, and Risks. Validity of the health profile-types was assessed by testing expected differences among adolescents according to sex, age, socioeconomic status, and self-reported conditions. Logistic models were built.

Results: A total of 13 health profile-types (10 that best fitted the data and three additional considered conceptually necessary) were identified. The largest group of adolescents was in the "Excellent health" or "Good health" types (43.4%), although 11.2% were in the "Worst health" profile. According to a priori hypotheses, being a girl (OR = 1.81; 95% CI = 1.26–2.60), older age (OR = 1.80; 1.26–2.57), and self-reported recurrent (OR = 2.49; 1.72–3.60) and psychosocial disorders (OR = 4.38; 2.92–6.56) were associated to the likelihood of a "Worst health" profile-type.

Conclusions: The Spanish CHIP-AE health profile-types offer a simplified method to describe adolescents' patterns of health, which is valid and similar to the original US taxonomy. This can facilitate interpreting the instrument scores and using it for needs assessment, although additional research is required.

Keywords: adolescents, cluster analysis, health profile-types, self-perceived health, spanish version.

Introduction

Although definitions of the concept of health status in children and adolescents were available since the 1970s [1], measurement of health-related quality of life in this population has only recently been attempted. One of the first generic health status instruments, the Child Health and Illness Profile-Adolescent Edition (CHIP-AE) developed in 1993 [2], elicits self-reports of perceived health from adolescents aged 11 to 17 years. It has shown acceptable validity and reliability coefficients [3], and has been used in several studies [4–7].

To simplify interpretation of results and summarize the information of the different domain and subdomain scores, the original developers of the CHIP-AE [8] used the taxonomy of the health profile-types, and obtained 13 mutually exclusive and exhaustive scoring patterns. These profile-types describe health categories according to the number and types of domain scores in the range of poor health: none, one, two, and three or four domains. Each CHIP-AE profile-type tended to group youths that may have a similar level of health status and/or specific needs for health services or specific interventions [6]. Reliability and validity of this method were established [9]. The CHIP health profile-types have been shown in previous studies to be related with academic achievement as well as demonstrated its usefulness to describe inequalities in health in children and adolescents [10,11].

The CHIP-AE has been adapted into Spanish, showing good psychometric properties [12,13], similar to the original instrument. In this study, we develop the profile-types obtained with the scores of the Spanish version of the CHIP-AE, and we determine whether or not they differentiate adolescents as expected, according to relevant health-related factors.

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Methods

Study Population

Adolescents aged 12 to 19 years who attended public and private schools in two different sites in Spain (the city of Barcelona and the village of Piera) were recruited and administered the Spanish version of the CHIP-AE during school year 1999 to 2000. The Barcelona (urban) sample participating in this study has been previously described [13,14]. Briefly, a two-stage cluster sampling of schools of the city of Barcelona was carried out. In the first stage, schools were selected, and in the second stage, a classroom out of six educational levels was selected in each school. In Piera (a semirural village of 6000 inhabitants village, 60 km northern Barcelona, Spain), all adolescents (12 to 19 years) attending the one public and the one private schools were selected. The addition of a semirural sample was considered necessary to increase the generalizability of the results.

The CHIP-AE

This instrument contains 183 items divided in 20 subdomains and forming six domains: Satisfaction (12 items), Discomfort (45), Resilience (31), Risks (39), Achievement (11), and Disorders (45) [15]. After the original US work, the scores of only four domains were analyzed to estimate the profile-types: Satisfaction (perceived level of health and well-being), Discomfort (specific physical and emotional sensations/feelings that interfere with comfort), Resilience (perceived states and behaviors potentially associated with positive future health, such as individual and familiar participation), and Risks (perceived states and behaviors that increase the likelihood of subsequent health problems or injuries). The remaining two domains were excluded in the original development of the profile-types. The Disorder domain scores presented insufficient variability because most youths reported acute conditions and few chronic disorders. In consequence, the Disorder domain did not add much to the empiric definition of the clusters. On the other hand, the Disorder domain may be skipped when medical records are available. The Achievement domain was excluded given that many youths did no report on work performance, what had caused the clusters to be defined in terms of relatively small differences in achievement scores but relatively large differences in other aspects of health, and also to optimize comparability with previous studies.

The CHIP-AE subdomain scores were obtained averaging the scores of items within each subdomain (in a 1-to-5 Likert scale), when at least 70% of the items were endorsed. And domain scores (n = 4) were computed as the average of their subdomains (n = 12). To facilitate interpretation, the scores were standardized to an arbitrary mean of 50 and a standard deviation (SD) of 10, considering the individual score and the reference group's mean in this typification. Higher scores reflect more satisfaction and resilience and less discomfort and risks.

Other Variables

Information on personal, sociodemographic characteristics, and health conditions was collected. Variables included: age (12 to 15 years or 16 to 19 years), sex, area of residence (urban or rural), type of school (public or private/subsidized), highest educational level achieved by any of the parents (primary, secondary or university degree), and self-reported health conditions. Among the latter, we included: recurrent disorders (e.g., asthma, otitis, allergies), psychosocial disorders (e.g., speech problem, eating problem, learning disability), and physical injuries (made up by grouping self-reported cuts or important scratches, bone fractures or joint injuries). Self-reported conditions were considered to be "frequent" when the Disorders domain score was lower than the cutoff point of 0.6 SD of the mean (i.e., a score of 44) in such a reported condition.

Development of the Health Profile-Types

Our aim was to identify health profile-types based on the CHIP-AE scores. Two sets of criteria were used: first, conceptual considerations made by the research group and then an empiric clustering of the domain scores. A final classification was developed after formally comparing the results of the two approaches.

Conceptual criteria. After a literature review [16] and the review of the original US profile-types [8], the same 13 categories original US categories were conceptualized. Subsequently, children were classified in one and only one of these conceptual categories after considering all their CHIP-AE domain scores as low (score of 44 or less), average (score of 44.1 to 55.9), and high (score of 56 points or higher). To that end, an arbitrary cutoff point of 0.6 SD of the standardized mean of 50 was used after the original US study (Table 1) [3,8,14].

Empirical criteria. We carried out a cluster analysis with the aim of grouping individuals into clusters as homogeneous as possible. Cluster analysis techniques may be hierarchical if the resulting classification has an increasing number of nested classes [17]. Nonhierarchical methods, like the k-means, assume data are partitioned and the numbers of cluster into the data are to be split should be anticipated by the analyst. Because we had no a priori number, the nonhierarchical method was considered more suitable to study the natural partitions of the data.

A hierarchical clustering was first performed in a random 10% of the sample. Each of the four domains' scores was used to identify the optimum number of clusters using the Euclidean distance to build the

Table I Conceptually defined health profile-types for the original US CHIP-AE

Profile-type	Specific CHIP-AE domain score categories (see text)
A Excellent health	Excellent health on three or four domains, with no domains of poor health
B Good health	At least average health on all domains, with excellent health on no more than two domains
C Dissatisfaction	Poor health only on Satisfaction
D Discomfort	Poor health only on Discomfort
E Low resilience	Poor health only on Resilience
F High risks	Poor health only on Risks
G Dissatisfaction/high discomfort	Poor health on Satisfaction and Discomfort
H Dissatisfaction/low resilience	Poor health on Satisfaction and Resilience
I Dissatisfaction/high risks	Poor health on Satisfaction and Risks
J Discomfort/low resilience	Poor health on Discomfort and Resilience
K Discomfort/high risks	Poor health on Discomfort and Risks
L Low resilience/high risks	Poor health on Resilience and Risks
M Worst health	Poor health on three or four domains

CHIP-AE, Child Health and Illness Profile-Adolescent Edition.

distances matrix. The Euclidean distance is used by default for interval data and is computed as the root square of the sum of the squared differences between scores for two individuals. The Ward test, based on the error sum of the squares i.e., the sum of the square distances between each element regarding the mean of the cluster it belongs, is then applied. The criterion for fusion between clusters (or cases) is that it should produce the smallest possible increase in the error sum of the squares. Subsequently, a nonhierarchical k-means procedure was carried out after an iterative process in the remaining sample (90%). In addition, a sensitivity analysis was conducted with different number of clusters to identify the number of clusters that best classified the data.

Integration of the two approaches. A set of contingency tables combining the health categories from the conceptual approach and the clusters that best fitted the data in the empiric approach was developed. All the sample observations were distributed in each table. Kappa statistics for variables with unequal ranges was used to measure the proportion of agreement between both methods, after correction by chance [18].

Construct Validity Hypotheses

Girls were expected to be more frequently in profile-types reflecting Discomfort and Dissatisfaction and in the "Worst health" profile compared to boys. Boys and older youths (16 to 19 years old) were expected to be more frequently in the "High risks" profile. And adolescents of lower socioeconomic status were also expected to be more frequently in the "High risks" as well as in the "Worst health" profiles. More youths reporting recurrent disorders were expected to have profiles defined by high Discomfort and low Satisfaction. Youths who reported psychosocial disorders were expected to be more frequently in the "Worst health" profile. And those who reported physical injuries were more likely to be in the "High risks" profile. No differences between youths from urban and those from rural area of residence were expected.

Construct Validity Analyses

The distribution of youths in health profiles, according to sex, age, highest family educational level, and health conditions, was assessed calculating 95% confidence interval in the total sample and stratified by geographic area of residence. Logistic regression models were adjusted to assess whether the a priori predicted associations with specific profile-types were present. The profile-types of "Excellent health" (profile-type A), "Worst health" (M), "High risks" (F), and "Discomfort and/or dissatisfaction" (C, D, and/or G) were compared with the remaining profile-types, simultaneously controlling for sociodemographic factors and health conditions. All the analyses were performed with the SPSS 11.5 version software (SPSS, Chicago, IL). A *P*-value of $\alpha = 0.01$ was considered for the level of statistical significance.

Nonadjusted and adjusted odds ratios (ORs) were used to assess whether a priori predicted associations with specific profile-types were present or not. In the epidemiologic literature, the OR is a widely used measure of association that is interpreted as approximately how much more likely it is for the outcome to be present among individuals with a particular characteristic, than among individuals without it [19]. Logistic regression was used to adjust the estimated OR of each variable for differences in distributions of and associations among sociodemographic and self-status variables like sex, age, the highest family educational level and self-reported conditions.

Results

Sample Characteristics

Of the 1774 adolescents selected for inclusion in the study, 14.5% (n = 259) were absent on the day of Spanish CHIP-AE's administration and for other 26 cases, parents refused permission for their children to participate in the study. The remaining 1489 adolescents completed the questionnaire, but 36 (2%) had to be excluded from the analyses, either because they were over 19 years of age (n = 17) or because there was insufficient information in the questionnaire (n = 19). The final response rate was of 82% (n = 1453). The samples were approximately balanced

Table 2 Comparison between conceptual and empiric solution (10-cluster solution: 1 to 10)

	Empirical solution										
Conceptual categories	1	2	3	4	5	6	7	8	9	10	Total
Excellent health (A)	0	0	0	0	27	8	0	0	1	**149**	185
Good health (B)	0	0	8	0	**163**	126	7	19	43	52	418
Dissatisfaction (C)	10	0	11	0	0	**64**	0	7	0	0	92
Discomfort (D)	0	0	23	0	0	7	**32**	0	4	4	70
Low resilience (E)	0	**63**	0	0	30	0	1	30	0	0	124
High risks (F)	0	0	2	0	1	0	0	15	**99**	2	119
Dissatisfaction/high discomfort (G)	4	0	**32**	0	0	3	1	0	0	0	40
Dissatisfaction/low resilience (H)	**34**	24	0	0	0	2	0	7	0	0	67
Dissatisfaction/high risks (I)	1	0	6	1	0	0	0	7	3	0	18
Discomfort/low resilience (J)	1	0	0	1	0	0	15	2	0	0	19
Discomfort/high risks (K)	0	0	8	2	0	0	14	2	17	0	43
Low resilience/high risks (L)	0	0	0	0	1	0	0	**36**	3	0	40
Worst health (M)	49	1	11	**69**	0	0	7	14	1	0	152
Total	99	88	101	73	222	210	77	139	171	207	1387

Bold numbers represent those profiles with a high number of individuals in both solutions.

by sex. Compared to the rural sample, higher proportions of older adolescents (16 to 19 years, 48.9% vs. 23.8%, $P < 0.01$), attending a private school (52.4% vs. 26.1% $P < 0.01$), and having a parent with a university degree (26.1% vs. 11.6%, $P < 0.01$) were found in the urban sample.

Identification of the Spanish CHIP-AE Health Profile-Types

Dendrogram from the hierarchical cluster analysis showed that the optimum number of clusters was 10. As planned, alternative solutions of 8, 9, 13, and 18 clusters were tested. When comparing all the contingency tables tested, the 10-cluster solution best classified the data, minimizing the dispersion of the 13×10 table, with a kappa = 0.48 (corresponding values for the other tables were: 13×8, k = 0.43; 13×9, k = 0.38; 13×11, k = 0.37, and 13×18, k = 0.28). The 10-cluster solution was substantially similar to the original taxonomy, except for three missing profile-types that had been considered conceptually relevant: "Dissatisfaction/high risks," "Discomfort/low resilience," and "Discomfort/high risks" (see Table 2). Because of the conceptual importance of these three profile-types and to maintain comparability with the US original version, it was decided to adopt the taxonomy of 13 profile-types.

Most adolescents were in the "Excellent health" and the "Good health" profiles (43.4%), although 11.2% were in the "Worst health" profile (Fig. 1).

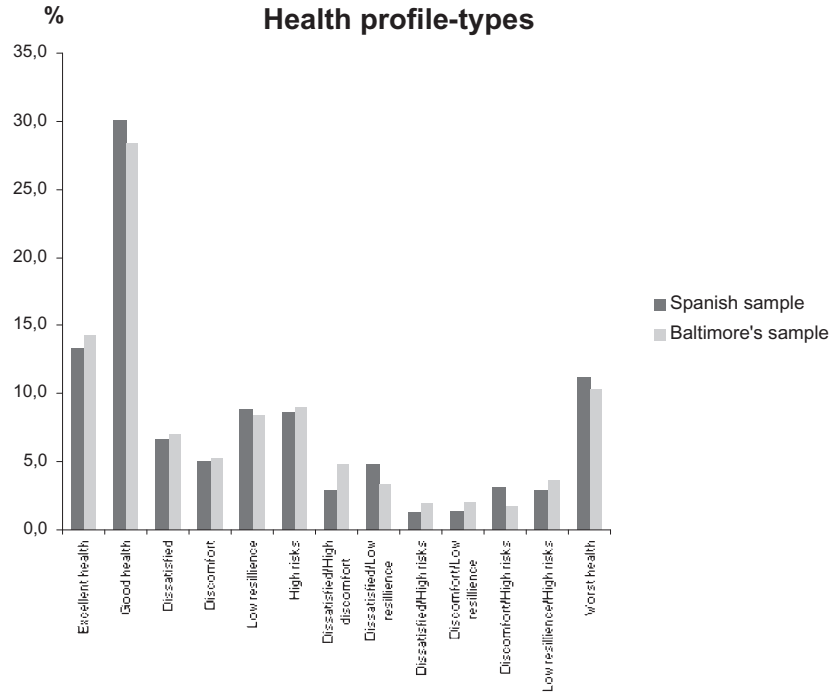

Figure 1 Distribution of the youths in profile-types in the Spanish sample (n = 1453) and in Baltimore (n = 863).

Table 3 Health profiles distribution, according to sex and age, in the Spanish sample

	Sex				Age (years)			
	Boys (n = 711)		Girls (n = 680)		12–15 (n = 831)		16–19 (n = 560)	
Health profile-type	%	CI 95%	%	CI 95%	%	CI 95%	%	CI 95%
Excellent health	17.6	(14.8–20.4)	8.8	(6.7–10.9)	18.1	(15.5–20.7)	6.3	(4.3–8.3)
Good health	33.3	(29.8–36.8)	26.6	(23.3–29.9)	29.7	(26.6–32.8)	30.5	(26.7–34.3)
Dissatisfied	4.4	(2.9–5.9)	9.0	(6.8–11.2)	6.7	(5.0–8.4)	6.4	(4.4–8.4)
Discomfort	3.5	(2.1–4.9)	6.6	(4.7–8.5)	5.4	(3.9–6.9)	4.5	(2.8–6.2)
Low resilience	9.0	(6.9–11.1)	8.8	(6.7–10.9)	11.7	(9.5–13.9)	4.8	(3.0–6.6)
High risks	11.5	(9.2–13.8)	5.4	(3.7–7.1)	4.6	(3.2–6.0)	14.5	(11.6–17.4)
Dissatisfied/high discomfort	1.4	(0.5–2.3)	4.4	(2.9–5.9)	2.8	(1.7–3.9)	3.0	(1.6–4.4)
Dissatisfied/low resilience	3.2	(1.9–4.5)	6.5	(4.6–8.4)	5.3	(3.8–6.8)	4.1	(2.5–5.7)
Dissatisfied/high risks	1.3	(0.5–2.1)	1.3	(0.4–2.2)	1.0	(0.3–1.7)	1.8	(0.7–2.9)
Discomfort/low resilience	0.6	(0.0–1.2)	2.2	(1.1–3.3)	1.6	(0.7–2.5)	1.1	(0.2–2.0)
Discomfort/high risks	2.8	(1.6–4.0)	3.4	(2.0–4.8)	2.4	(1.4–3.4)	4.1	(2.5–5.7)
Low resilience/high risks	3.4	(2.1–4.7)	2.4	(1.2–3.6)	2.4	(1.4–3.4)	3.6	(2.1–5.1)
Worst health	8.0	(6.0–10.0)	14.6	(11.9–17.3)	8.4	(6.5–10.3)	15.4	(12.4–18.4)

Missing values in 62 cases (4.3%) of the sample for age and sex.

Health profile-types distribution was remarkably similar to the original US sample.

Construct Validity of the Spanish CHIP-AE Health Profile-Types

Table 3 shows the health profile-types distribution, according to sex and age. As hypothesized, girls were more frequently in the "Worst health" profile compared to boys (14.6% vs. 8.0%), and in the "Dissatisfaction, Dissatisfaction/low resilience," and "Dissatisfaction/discomfort" profiles. On the other hand, boys were more frequently in the "High risks" profile (11.5% vs. 5.4%) and in the "Excellent health" profile. There were no statistically significant differences according to sex in the rest of profile-types.

Also as anticipated, older youths were significantly more frequently in profiles reflecting poorer health, such as "Worst health" and "High risks" profiles (15.4% vs. 8.4% and 14.5% vs. 4.6%, respectively); and younger youths were more frequently in "Excellent health." An unexpected finding was the low frequency of "Resilience" profiles among younger youths. There were no statistically significant differences according to age in the rest of profiles. Although there was a higher proportion of adolescents in families with university degree in the "Excellent health" than in the rest of the profiles, differences did not reach statistical significance.

Table 4 shows the health profile-types distribution, according to health conditions. Adolescents who reported recurrent disorders were more frequently in the "Worst health" and the "Dissatisfaction and/or discomfort" profiles than adolescents without conditions (22.0% vs. 8.2% and 5.8% vs. 2.0%, respectively). Also adolescents who reported psychosocial disorders were more frequently in the "Worst health" profile than those who did not had disorders (32.7% vs. 8.3%). Adolescents with physical injuries were more frequently in the "High risks" profile (14.0%, vs. 7.5% for those reporting no injuries). The rest of profile-types did not present statistically significant differences when comparing adolescents with and without any reported disorders. Finally, no differences were observed in these comparisons when stratifying by type of sample (urban vs. rural).

Table 5 shows the nonadjusted and adjusted likelihood of pertaining to selected profile-types: "Excellent health," "Worst health," "High risks," and "Discomfort/dissatisfied." Girls (OR = 0.44; 95% CI = 0.31 to 0.62), older youths (OR = 0.30; 95% CI = 0.20 to 0.44), and adolescents who reported frequent recurrent disorders (OR = 0.21; 95% CI = 0.11 to 0.41) or frequent psychosocial disorders (OR = 0.19; 95% CI = 0.07 to 0.52) were less likely to be in the "Excellent health" profile than boys, younger youths, and adolescents who did not report recurrent or psychosocial disorders.

The factors associated with the "Worst health" profile were: being a girl (OR = 1.81; 95% CI = 1.26 to 2.60), older age (OR = 1.80; 95% CI = 1.26 to 2.57), and reporting frequent recurrent disorders or psychosocial disorders (OR = 2.49; 95% CI = 1.72 to 3.60 and OR = 4.38; 95% CI = 2.92 to 6.56, respectively). Older age and self-reported physical injuries were associated with a "High risks" profile. Being a girl represented a protective factor for being in a "High risks" profile (OR = 0.46; 95% CI = 0.30 to 0.69). The factors associated with the "Discomfort and/or dissatisfaction" profile were being a girl and reporting frequent recurrent disorders.

Discussion

The taxonomy presented here combined the standardized scores of four CHIP-AE domains to assign each individual to one out of the 13 mutually exclusive health profile-types. These profile-types represent a substantial simplification of this instrument scoring

Table 4 Distribution of the CHIP-AE health profile-types according self-reported health conditions in Spanish youths

	Frequent* recurrent disorders				Frequent psychosocial disorders				Frequent* physical injuries			
	Yes (n = 295)		No (n = 1084)		Yes (n = 162)		No (n = 1221)		Yes (n = 235)		No (n = 1145)	
Health profile-type	%	CI 95%	%	CI 95%	%	CI 95%	%	CI 95%	%	CI 95%	%	CI 95%
Excellent health	3.4	(1.3–5.5)	16.1	(13.9–18.3)	2.5	(0.1–4.9)	14.8	(12.8–16.8)	11.9	(7.8–16.0)	13.6	(11.6–15.6)
Good health	25.1	(20.2–30.0)	31.3	(28.5–34.1)	18.5	(12.5–24.5)	31.6	(29.0–34.2)	23.4	(18.0–28.8)	31.4	(28.7–34.1)
Dissatisfied	6.8	(3.9–9.7)	6.6	(5.1–8.1)	6.8	(2.9–10.7)	6.6	(5.2–8.0)	4.7	(2.0–7.4)	7.1	(5.6–8.6)
Discomfort	7.5	(4.5–10.5)	4.4	(3.2–5.6)	7.4	(3.4–11.4)	4.8	(3.6–6.0)	4.3	(1.7–6.9)	5.1	(3.8–6.4)
Low resilience	6.1	(3.4–8.8)	9.6	(7.8–11.4)	4.9	(1.6–8.2)	9.3	(7.7–10.9)	5.1	(2.3–7.9)	9.7	(8.0–11.4)
High risks	9.8	(6.4–13.2)	8.2	(6.6–9.8)	8.0	(3.8–12.2)	8.6	(7.0–10.2)	14.0	(9.6–18.4)	7.5	(6.0–9.0)
Dissatisfied/high discomfort	5.8	(3.1–8.5)	2.0	(1.2–2.8)	6.2	(2.5–9.9)	2.4	(1.5–3.3)	3.0	(0.8–5.2)	2.9	(1.9–3.9)
Dissatisfied/low resilience	3.7	(1.5–5.9)	5.2	(3.9–6.5)	4.9	(1.6–8.2)	4.8	(3.6–6.0)	2.6	(0.6–4.6)	5.3	(4.0–6.6)
Dissatisfied/high risks	0.7	(0.0–1.7)	1.5	(0.8–2.2)	0.6	(0.0–1.8)	1.4	(0.7–2.1)	2.1	(0.3–3.9)	1.1	(0.5–1.7)
Discomfort/low resilience	2.4	(0.7–4.1)	1.1	(0.5–1.7)	0.6	(0.0–1.8)	1.5	(0.8–2.2)	1.7	(0.0–3.4)	1.2	(0.6–1.8)
Discomfort/high risks	4.7	(2.3–7.1)	2.7	(1.7–3.7)	5.6	(2.1–9.1)	2.8	(1.9–3.7)	6.0	(3.0–9.0:)	2.5	(1.6–3.4)
Low resilience/high risks	2.0	(0.4–3.6)	3.1	(2.1–4.1)	1.2	(0.0–2.9)	3.1	(2.1–4.1)	5.1	(2.3–7.9)	2.3	(1.4–3.2)
Worst health	22.0	(17.3–26.7)	8.2	(6.6–9.8)	32.7	(25.5–39.9)	8.3	(6.8–9.8)	16.2	(11.5–20.9)	10.2	(8.4–12.0)

*Frequent disorders/injuries, a score of >0.6 SD lower than the corresponding mean domain score.
5.1%, 4.8%, and 5.0% of individuals in the sample had insufficient information about recurrent and psychosocial disorders or physical injuries, respectively.
CHIP-AE, Child Health and Illness Profile-Adolescent Edition.

Table 5 Association of personal characteristics and health conditions with selected CHIP-AE health profile-types (n = 1453)

	%	Unadjusted OR (CI 95%)	OR (CI 95%)†
Excellent health profile-type			
Sex			
Boys	17.6	1*	1*
Girls	8.8	0.45 (0.33–0.63)	0.44 (0.31–0.62)
Age (years)			
12–15	18.1	1*	1*
16–19	6.3	0.30 (0.21–0.44)	0.30 (0.20–0.44)
Recurrent disorders			
No	16.1	1*	1*
Yes	3.4	0.18 (0.10–0.35)	0.21 (0.11–0.41)
Psychosocial disorders			
No	14.8	1*	1*
Yes	2.5	0.15 (0.05–0.40)	0.19 (0.07–0.52)
Worst health profile-type			
Sex			
Boys	8.0	1*	1*
Girls	14.6	1.95 (1.38–2.76)	1.81 (1.26–2.60)
Age (years)			
12–15	8.4	1*	1*
16–19	15.4	1.97 (1.41–2.76)	1.80 (1.26–2.57)
Recurrent disorders			
No	8.2	1*	1*
Yes	22.0	3.16 (2.22–4.48)	2.49 (1.72–3.60)
Psychosocial disorders			
No	8.3	1*	1*
Yes	32.7	5.39 (3.66–7.93)	4.38 (2.92–6.56)
High risks profile-type			
Sex			
Boys	11.5	1*	1*
Girls	5.4	0.44 (0.29–0.66)	0.46 (0.30–0.69)
Age (years)			
12–15	4.6	1*	1*
16–19	14.5	3.53 (2.36–5.27)	3.52 (2.35–5.29)
Physical injuries			
No	7.5	1*	1*
Yes	14.0	2.01 (1.31–3.09)	1.83 (1.17–2.85)
Discomfort/ dissatisfaction profile			
Sex			
Boys	9.3	1*	1*
Girls	20.0	3.23 (1.57–6.67)	2.41 (1.75–3.31)
Recurrent disorders			
No	13.1	1*	1*
Yes	20.0	2.95 (1.55–5.63)	1.50 (1.06–2.12)
Psychosocial disorders			
No	13.8	1*	1*
Yes	20.4	2.70 (1.29–5.65)	1.45 (0.94–2.22)

*Reference category.
†ORs are adjusted by age, sex, self-reported conditions, and the highest family educational level.
Unadjusted and adjusted regression models.
CHIP-AE, Child Health and Illness Profile-Adolescent Edition.

system, which should facilitate the interpretability and the use of the instrument. It is important to note that this type of approach can be used for other multidimensional psychometric instruments. The profile-types obtained for the Spanish CHIP-AE are consistent with all our a priori hypotheses, supporting the construct validity of this taxonomy. Moreover, they are very similar to those identified for the original US instrument, suggesting the cross-cultural equivalence of the taxonomy.

Two major features make this taxonomy more easily interpretable than a health index based on individual dimension scores. First, the profile-types taxonomy is based on a conceptual grouping of scores, thus facilitating the substantive interpretation of each of the profile-types. Importantly, this grouping is supported by the empiric distribution of the data. A second supportive feature is that the taxonomy dramatically reduces the range of different possible scores for the questionnaire: from continuous scores in four different domains to just 13 exclusive overall health states. Such a reduction allows for a much simpler and yet meaningful taxonomy of health states. Moreover, our results show a reasonable distribution of the sample across these states. Simplicity and interpretability of the health profile-types are key characteristics for the successful use of a health status instrument.

Although not very common in the specialized literature, health profiles have been used in psychology to describe personality patterns [20], and also in psychiatry to characterize the patterns of use of services in schizophrenia [21] or factors affecting quality of life in dementia [22]. Other studies, such as the development of health profile-types using cluster analysis with the data on the Medical Outcomes Study 36-Item Short Form (SF-36), have shown the utility of this method to identify clinical changes and to measure the impact in functional and emotional status of patients with chronic conditions. In these studies, the profile-types have demonstrated to be a potential tool to assess outcomes and to identify the most appropriate health intervention according to the profile to which patients were assigned to [23–27]. Similarly, other study using the CHIP-AE profile-types showed that adolescents from more advantaged social classes were approximately 70% more likely to be in the excellent/good health profile and 80% less likely to be in the poorest health profile than their counterpart in the disadvantages social class [11]. Future studies should analyze whether the profiles are useful to predict the use of services and the health-care services needs in adolescents.

Compared to other methods, the profile-types would present some advantages. First, the traditional use of a simple sum or an average score index although it reflects the situation of the individual in the continuum of ill-health, it does not provide qualitative clues about the nature of the health domains affected. In addition, averaging methods may mask individual problems. Conversely, the profile-types presented in our study provide a useful taxonomy of health states

using a relatively small, manageable number of possible health states. Finally, the profile-types provide an exhaustive classification of which all the individuals completing the instrument being classified in one and only one type.

Our study supports the cross-cultural validity of the taxonomy of the CHIP-AE, thus confirming its usefulness in settings different from the one they were originally developed. In addition, they provide interesting information about possible health needs of children and adolescents. For instance, according to the results presented here, almost half of this sample made of mostly healthy children, presented some need for care. Those reporting psychosocial conditions seemed to be especially vulnerable. Our results show also an association between poor levels of health in the Discomfort domain and recurrent health conditions, especially among girls, risk behaviors, and accidents.

The present study has proved that health profiles based on the Spanish version of the CHIP-AE have the expected construct validity, identifying predictable differences according to sex, age, and self-reported conditions. As we had hypothesized based in previous work, girls were found more likely to be in the "Worst health" and "Dissatisfaction and/or discomfort" profiles than boys [28–30]. These results could be due to different patterns of socialization and of interiorization-exteriorization of social and cultural values that differentially influence health self-perception among boys and girls [31]. Consistent with prior studies showing that high-risk behavior increases with age [6,32], we found that older adolescents were more likely to be in the "High risks" profile than younger ones. Adolescents who reported frequent recurrent or psychosocial disorders were more likely to be in the "Worst health" profile [4,5,33–35] and adolescents who reported physical injuries were more likely to be in the "High risks" profile [36]. Somewhat unexpectedly, younger youths were classified as "Low resilience" more frequently than older youths. This may well be due to some aspects of the complexity of the content of the domain of resilience (i.e., health and home safety, or physical activity) that include eating habits and involvement in a variety of physical fitness activities. Recent data suggest that prevalence of children obesity has dramatically increased in Spain during the last decade, with a generalized social concern [37]. This problem seems to be more important among the youngest.

Despite the evidence for the validity of this profile taxonomy for use in Spain, there are possible limitations arising from the restriction of the sample to a school-based population who are reporting on their self-perceptions and health conditions. Self-reported conditions in adolescents usually show low reliability and validity [5]. Although a high internal consistency was not expected, because there is no reason to believe that any reported condition should be related to each other, a very high test–retest correlation was observed for recurrent and psychosocial conditions scores of the CHIP in a previous study (0.80 and 0.89, respectively) [12]. Longitudinal studies should further explore the predictive validity of the profile-types to assess their utility as a method to measure changes before and after health interventions.

A limitation for the use of the adolescent version of the CHIP is its length, as it includes 183 items. Nevertheless, the instrument can be substantially shortened by not administering the 45 items from the Disorder domain in clinical settings, because it is not used for computing the health profile-types and chronic conditions can be assessed by consulting the clinical records. Important efforts should be made trying to simplifying extension scoring and interpretation of the results on patient oucome measures, and the health profile-types are one step in this direction.

An important point concerning the usefulness of the health profile-types taxonomy is to further establish the validity of the different profiles beyond their descriptive and classification capacity. Future work needs to provide additional evidence about the degree of distinctness among the profile-types. For instance, it would be useful to determine whether specific interventions would be more appropriate and effective for adolescents in different profile-type. Theoretically, interventions focused on improvement of physical and psychological symptoms should improve scores in the "Dissatisfaction and discomfort" profile. Conversely, interventions directed at improving their family relationships and their ability to solve problems should help adolescents in "Low resilience" and "High risks" profiles. These considerations, along with an attempt to develop the most parsimonious set of profile-types, will require attention in subsequent research involving different population groups and settings.

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